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BUR-CLOVER CULTIVATION *and* UTILIZATION



BUR-CLOVERS are winter annual legumes and are used for pasturage and green manure. They are valued particularly because they so readily maintain themselves with little or no reseeding and because each year they can be depended on to add humus and nitrogen to the soil without sacrificing the regular summer crop of the farm.

Mild climatic conditions are essential for the successful growth of these plants. They require moderately fertile soil and when grown on poor land should receive an application of 400 pounds per acre of superphosphate or complete fertilizer high in superphosphate.

Seedings should be made sufficiently early in the fall so that the plants will become well established before winter. Seedings can be made broadcast or with a drill, 5 or 6 bushels of seed in the bur being used for broadcasting or 15 pounds of hulled seed for drilling. The seed should be hulled and scarified or given the hot-water treatment to make the hard seed germinable and to insure good stands.

Inoculation is essential in the Southern States except on lands that have grown bur-clover successfully. Most soils in the West seem to be well inoculated.

Bur-clover affords excellent pasturage and at low elevations on the range lands of California is one of the principal plants.

Where bur-clover can volunteer from year to year in cultivated land it affords one of the best and cheapest cover crops. When the crop is harvested for seed the burs are allowed to mature and drop to the ground, and are then swept together with barn brooms or harvested with special harvesters.

Spotted bur-clover yields from 150 to 350 pounds of hulled seed per acre, and California bur-clover yields from 30 to 500 pounds.

Where bur-clover succeeds in the South, and can volunteer, it is the least expensive winter cover crop to seed in cotton and corn. Its use as a cover crop prevents the washing of the soil.

This bulletin is a revision of and supersedes Farmers' Bulletin 693, Bur Clover.

BUR-CLOVER CULTIVATION AND UTILIZATION

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INTRODUCTION

BUR-CLOVERS are annual legumes, much like ordinary clovers, but the small yellow flowers are in clusters of 5 to 10, and the coiled pods are commonly beset with spines, thus forming the so-called "bur." The roots are fibrous and do not extend very deep. Most of the plants are branched at the crown, and have 10 to 20 or more spreading or decumbent branches 6 to 30 inches long, which when in fruit are thickly beset with burs. Well-developed plants may contain more than 1,000 pods. Bur-clovers are valuable agriculturally only where the winters are mild—in the United States in the cotton-growing area of the South and all of the Pacific coast west of the Cascade and Sierra Nevada Mountain Ranges.

Bur-clover is highly regarded particularly because it so readily maintains itself with little or no reseeding, and because each year it can be depended on to add humus and nitrogen to the soil without sacrificing the regular summer crop of the farm. For the South, especially, bur-clover is the cheapest legume that serves as a winter cover crop, thus preventing the washing of the soil. In addition to its value as a winter cover crop, it furnishes some pasturage and improves the soil. Many instances are reported in which the cotton crop has been materially increased each season by the use of bur-clover alone.

KINDS OF BUR-CLOVER

There are two species of bur-clover commonly cultivated in the United States, namely, the spotted or southern bur-clover (*Medicago arabica*; fig. 1) and the California or toothed bur-clover (*M. hispida*; fig. 2). Tifton bur-clover (*M. rigidula*) is a more recently intro-

duced species that has been grown and distributed from the Georgia Coastal Plains Experiment Station, located at Tifton, Ga., but has not yet become established commercially. Another species, *M. minima*, has been naturally introduced in a number of places in the Southern States and is gradually spreading. *M. minima* is comparable with spotted bur-clover in winter hardiness, but Tifton bur-clover is the most hardy of all and usually will survive most winters as far north as Washington, D. C.

The Tifton bur-clover is readily distinguished by its hard, spiny, comparatively large bur, while *M. minima* is readily recognized by its very small and soft spiny bur. The spotted or southern bur-clover is distinguishable by the purple spot in the center of each leaflet. Toothed

bur-clover has no outstanding features; it is readily distinguished, however, from the spotted bur-clover, which it most nearly resembles, by the lack of the large brown spot in the center of the leaf and differences in bur characters (figs. 3 and 4). A pod of spotted bur-clover contains from 2 to 8 seeds; in California bur-clover the usual number is 3, but there are often as many as 5.

In addition there are about 35 other species, some of which have large, smooth burs, while others have very hard and spiny burs. All of these are native to the Mediterranean region, although a few occur naturally as far east-

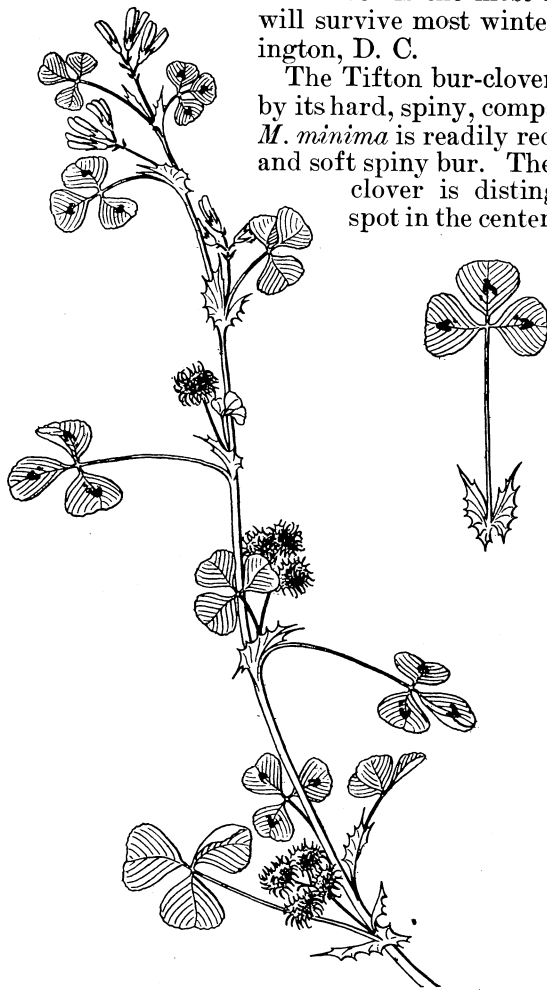


FIGURE 1.—Spotted bur-clover (*Medicago arabica*).

ward as Turkistan. There is a variety of the spotted bur-clover with spineless pods, and several similar varieties of the California bur-clover. These, together with others with large spineless burs, as buttonclover (*M. orbicularis*), snailclover (*M. scutellata*), and tubercled clover (*M. tuberculata*), have been tested to determine their value as compared with the spiny varieties.

VALUE OF SPINELESS BUR-CLOVERS

In experimental plantings under cultivation, the spineless, spotted, California, and other bur-clovers have all made good growth and matured good crops of seed. Under pasture conditions they have made good growth and matured seed when not grazed too closely during the fruiting season. Experience has shown, however, that the varieties with large spineless burs cannot be maintained in pastures except when given special attention and protection. The seed of spineless varieties with small burs escape grazing animals more readily and, consequently, are more persistent, and are not uncommon in California.

Since the spiny varieties of bur-clover are now widely distributed in areas where bur-clovers are adapted, any plantings of spineless varieties would soon be mixed with those having spines. It appears, therefore, that there is no practical value in these spineless forms.



FIGURE 2.—California bur-clover (*Medicago hispida*).

CLIMATIC ADAPTATIONS

All of the bur-clovers are normally winter annuals; that is, in the country to which they are native they germinate in the autumn, grow during the fall, winter, and early spring, and mature early in the summer. They are thus primarily adapted to regions with mild, moist winters, and in this country maintain themselves naturally only in the areas shown by the shading in figure 5. Northward from the areas indicated they succeed fairly well when the seed is sown in the spring, but are scarcely able to maintain themselves by reseeding from year to year.

On the Pacific coast, especially in California, along streams and in shady situations, spotted bur-clover is now nearly as abundant as California bur-clover. In the Southern States spotted bur-clover is

decidedly better adapted to the conditions than California bur-clover. The latter, however, appears able to maintain itself from year to year in the less humid portions of eastern Texas and in parts of



FIGURE 3.—Pods of spotted bur-clover.

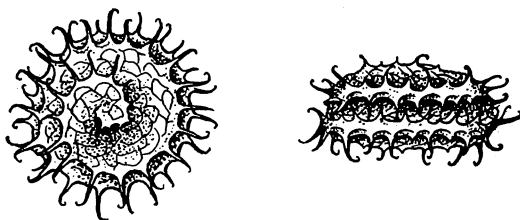


FIGURE 4.—Pods of California bur-clover.

southern Oklahoma. There is also evidence to indicate that California bur-clover is destroyed in winter by temperatures that do little or no harm to the spotted bur-clover. The latter, therefore, is to be preferred in the cotton States, where California bur-clover cannot be so highly recommended. In the Pacific coast area from Oregon south to Arizona and in the Great Plains area of eastern Texas and southern Oklahoma bur-clover is a valuable

winter annual pasture plant and is especially well thought of throughout that region for its high feeding value.

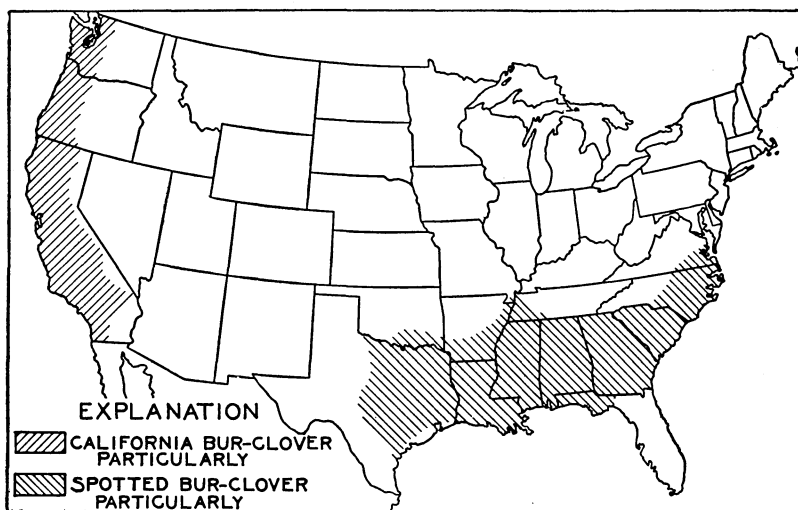


FIGURE 5.—Outline map of the United States, showing the regions to which bur-clover is adapted.

Bur-clover may be pastured in North Carolina by the middle of February, and near the Gulf coast it furnishes practically continuous winter pasturage. Few legumes will make more growth in that area during cool weather.

SOIL PREFERENCES

Bur-clover will succeed in practically all types of soil, but loams are most suitable. In the South the plants grow best in soils rich in lime, but they thrive well enough in soils poor in this substance. Apparently the plant is not indifferent to lime, but it will succeed in noncalcareous soils. As a rule it prefers moist, well-drained soils, but in California it grows vigorously in adobe soils, which are often poorly drained. Where the soil is very moist the plants mature much later than on well-drained land. The California Agricultural Experiment Station found that California bur-clover would grow luxuriantly in alkali soil containing 11,300 pounds of carbonate of soda to an acre in the top 30 inches. Apparently the plant is as tolerant of alkali as is barley. In general, bur-clover succeeds well in slightly alkaline soils, but not in those heavily charged with salts.

FERTILIZER REQUIREMENTS

Bur-clover does poorly on soils of low fertility. In establishing stands, except on very fertile soils, the use of liberal quantities of stable manure or commercial fertilizer is recommended. Usually superphosphate is the most essential fertilizer ingredient, and the use of 400 pounds per acre of this is all that is needed. In some cases potash is beneficial, and on very poor soils the addition of nitrogen will give increased growth.

TIME OF SEEDING

Bur-clover should always be sown in late summer or fall. In the cotton States the best time of seeding is the months of August and September, when seed in the bur is used, but seedlings as late as November may give favorable results, even as far north as South Carolina. Late seedings, however, are to be avoided whenever possible, as but little fall and winter growth is secured from such plantings. Hulled seed germinates more readily than seed in the bur, so that where hulled seed is used the time of sowing may be delayed on an average from 2 to 4 weeks longer than if seed in the bur is used.

In California, where the summers are always dry, seeding may be delayed until just before the fall rains begin. If the sowings are to be made on irrigated land, the best average date is about the first of October, since by seeding at this time only a single irrigation is ordinarily necessary; that is, the one made just before seeding. If the seeding is done earlier, a second irrigation may be necessary before the rains come; otherwise the young plants are likely to be injured by drought.

SOWING THE SEED

Hulled seed may be sown by a grain drill with a press-wheel attachment, or by any method of broadcasting, about 15 pounds of seed being used per acre. A firm seed bed is essential, and especial care should be taken to cover the seed thinly. Under most conditions broadcasting will be found most satisfactory, but the seed should

be harrowed lightly. Where moisture conditions are entirely favorable, good stands have frequently been obtained by merely scattering the seed on the surface, but whenever practicable harrowing is recommended.

When the seed is sown in the bur, broadcasting is the only practicable method. To obtain a full stand by this method, from 5 to 10 bushels of seed per acre are necessary, followed by a harrowing.

In the regions that are well adapted to bur-clover it is much more economical as a rule to begin with a light seeding and to depend in subsequent years on the volunteer crop, where this is practicable.

GERMINATION OF THE SEED

Bur-clover seed in the bur retains its vitality for a number of years. Hulled seed deteriorates more readily but usually gives a high percentage of germination for 3 years or more. In all cases seed in the bur contains a high percentage of hard seeds, most of which do not germinate until the second year or later. Hulled seed usually germinates readily. On account of the high percentage of hard seed it contains, unhulled seed often gives poor stands, and for this reason hulling or special treatment to induce germination is recommended.

Independent investigations by McNair,¹ of the Office of Farm Management and Costs, Bureau of Agricultural Economics, United States Department of Agriculture, and by Duggar and Tisdale,² of the Alabama Agricultural Experiment Station, have shown that this difficulty of germination can be largely overcome by treating the seed in the bur with boiling water before it is sown. As a result of these investigations, the following method is recommended: (1) Empty a bag of the burs into a tub of cool water and let them stand for 2 hours, stirring occasionally to loosen as much dirt as possible for reinoculating the burs at the end of the hot-water treatment; (2) remove the burs from the tub of cool water, put them in a bag, and immerse for 5 minutes in a barrel of water almost scalding hot; (3) plunge the bag of burs for 1 minute in water kept boiling hot; (4) lift the bag of burs from the boiling water, plunge first into a barrel of cool water, and then empty into the tub of muddy water in which the seed was first placed. The muddy water tends to inoculate the burs, which have presumably had their inoculating bacteria killed by immersion in the boiling water. This inoculation is not necessary where the land to be planted is known to be already inoculated for bur-clover. Sow the seed immediately or spread it out to dry as rapidly as possible in an airy, shady place.

INOCULATION

On the Pacific coast, where bur-clover is established practically everywhere, inoculation is not necessary. In the cotton States, however, lack of inoculation apparently has often been the cause of failure in establishing bur-clover crops, especially where hulled seed was sown. Often when seed is sown in the bur there are enough

¹ McNAIR, A. D. BOILING BUR-CLOVER SEED TO HASTEN GERMINATION. *Prog. Farmer* [Raleigh, N. C.] 29 (38): 997. 1914.

² DUGGAR, J. F., and TISDALE, H. B. BUR-CLOVER SEED; MEANS OF HASTENING THEIR GERMINATION. *Ala. Agr. Expt. Sta. Circ.* 29, pp. 113-116. 1914.

bacteria in the dust on the burs to insure inoculation. It is desirable, however, in planting bur-clover for the first time, that farmers should not go to the expense of purchasing a large quantity of seed, but that a comparatively small area be planted, the soil being inoculated either by the soil-transfer method or, in the absence of inoculated soil, by the use of pure cultures. When once a patch of bur-clover has been successfully grown on a farm, the whole farm can be inoculated by scattering soil from the places where the bur-clover grew successfully.

SOIL-TRANSFER METHOD

The soil-transfer method is the surest known way to secure the inoculation of any legume. The soil should be taken from a spot where bur-clover is growing successfully or from fields of alfalfa, blackmedic, or melilot. The same germ inoculates all four of these plants, so that soil from near the roots of any one will inoculate the others. The soil should be taken from the top 8 inches and broadcast over the area to be planted at the rate of 500 pounds per acre. Care should always be taken to secure soil free from troublesome weeds or diseases.

On account of the expense involved and the danger of introducing diseases and insect pests, it is seldom advisable to get soil from a distance. It is better to sow but a small patch the first year, which, if successful, will supply abundant soil to use as inoculation for more extensive plantings. If stable manure is liberally used the chances of inoculation are greatly enhanced.

Sometimes inoculation is secured by dusting the seed with well-inoculated soil.

Even if a little seed is sown without inoculation, especially if the seed is in the bur, some of the plants are likely to have nodules on their roots. In this manner large areas of land may be gradually inoculated at merely the expense of a small amount of seed.

PURE-CULTURE METHOD

Pure cultures in glass containers may now be secured for nearly all legume crops. Where these are used, it is strongly recommended that only a small area be planted at first, and preferably on good or manured soil. As pure cultures frequently fail to provide inoculation, they should not be depended upon when large fields of a new legume are sown for the first time. Where soil is not available, however, they furnish the most convenient method of securing inoculation in small plantings.

VOLUNTEER CROPS OF BUR-CLOVER

One of the advantages of bur-clover over most other legumes is the fact that good stands can often be obtained from year to year without additional seeding. On pasture lands, where once established, bur-clover will reseed itself indefinitely.

On cultivated land the same thing is true, provided the land is not plowed until some of the burs have ripened. However, for most summer crops as commonly planted it is impractical to allow the bur-clover to remain on the land so long. This is particularly true

of corn and cotton. With these and other row crops, stands of bur-clover for the succeeding fall can be secured when the plantings of row crops are in wide rows (4 to 5 feet) which make possible the seeding of the current year's corn or cotton between the old rows that are left as "balks" in which the bur-clover can mature and be worked down later.

With rows of cotton 6 or 7 feet wide it is possible to interplant with cowpeas or soybeans after the matured bur-clover has been plowed down. The dried bur-clover plants should be turned under rather shallowly, because, if the seeds are buried deeply, the stand will probably be thin. On the whole, however, it is better to grow the seed in a separate patch, gather it when ripe, and then sow in the cultivated crop where desired. Under some conditions bur-clover seed will retain its vitality in the soil for 4 or 5 years, so that where it once is well established volunteer stands are common.

BUR-CLOVER FOR PASTURES

Bur-clover is utilized mostly as pasture for hogs, cattle, sheep, and poultry. Farm animals do not eat it readily at first, but they soon acquire a taste for the plant and then eat it freely. In Argentina, where both the California and the spotted bur-clover occur, it is said that horses will eat the former quite readily but absolutely avoid the latter. No similar observations have been recorded for California, where the two species grow together. When bur-clover is growing in cultivated lands it is best not to pasture continuously, but to put the stock on the land for only a few hours each day, as this reduces very much the injury by trampling. Few cases have been recorded of bur-clover causing bloat, but where the growth is lush care should be exercised. Not only do animals eat the herbage, but sheep, especially, are very fond of the ripe pods and will lick them from the ground. Much of the value of range lands in California depends on the large crop of pods produced by the bur-clover, which remain in good condition a long time. When the burs are abundant in the pasturage, sheep fatten very rapidly. The spines bother the animals only slightly, but the burs are eaten more readily when they have been softened by rain.

For permanent pastures in the South, a combination of bur-clover and Bermuda grass is very satisfactory. The Bermuda grass furnishes pasturage during the warm weather until further growth is stopped by frost, whereas the bur-clover begins to grow with cool weather in the fall and provides pasturage during the winter and spring. Where once established on such pastures it reproduces itself continuously. On Bermuda-grass pastures where bur-clover is not established, it is recommended that furrows be plowed through the Bermuda grass from 5 to 10 feet apart and seed of bur-clover, preferably in the bur, be sown in these plowed furrows in September. Within a year or two the plants produced in these plowed furrows will seed the whole pasture. Disking such a pasture in summer tends to stimulate the Bermuda grass. Broadcasting about 1 bushel of bur-clover seed in the bur to each acre before disking the Bermuda grass will usually give a stand of the bur-clover.

USE AS A COVER AND GREEN-MANURE CROP

Bur-clover alone is commonly used as a green-manure crop in the orchards of California and is often so handled that good volunteer crops are obtained year after year.

In the South, undoubtedly the greatest value of bur-clover is the fact that it is the cheapest and most easily handled legume that can be used as a combination cover and green-manure crop. Even a growth only a few inches in height is sufficient to prevent to a large degree the washing of the land in winter and, when plowed under, to add sufficient humus and nitrogen to improve materially the following cotton crop. It is the most economical legume to use for this purpose, as when once a stand has been secured and rows of the plants are left to seed it will volunteer from year to year. The same method can be used with corn or any other intertilled summer crop. There is some difficulty in seeding bur-clover in standing cotton, as in the harrowing of the bur-clover seed some of the ripe cotton is pulled out of the bolls. For this reason, the harrowing should be done just after the pickers have been through the field, thus avoiding as far as possible any injury to the opened bolls. When or where there is objection to using the balk system just described, corn can be grown occasionally in rotation with the cotton. It is possible to have a good stand of bur-clover each year without annual seeding by allowing a bur-clover crop to mature seed once every 4 or 5 years, and in that year, after plowing the bur-clover under, planting a crop of late corn as the season's cash crop. This is perhaps the most extensively used system in growing bur-clover with cotton.

There are many well-authenticated farm records that show that by using bur-clover in rotation with cotton the yields of cotton have shown marked increase year after year. There is apparently no other legume that can be used with as low cost as bur-clover for this purpose. The use of a summer legume crop, such as cowpeas or soybeans, is advisable in good rotations, but where cotton is grown continuously it involves the omission of this crop for an entire growing season. It is much cheaper and much more satisfactory to use bur-clover, which, after it is once established, does not involve much expense for producing seed, nor require the loss of a growing season, as does a summer legume crop. Furthermore, it adds each year a reasonable amount of humus and nitrogen, which in the end gives much more satisfactory results than turning under a large green-manure crop at long intervals. Perhaps no one thing will tend to bring about an increased yield from cotton fields more cheaply than the general use of bur-clover as winter cover and a green-manure crop.

VALUE AS HAY

Under favorable conditions bur-clover will make a dense stand 18 to 24 inches high. From such dense stands of bur-clover, yields of 2 or even 3 tons of hay per acre have been recorded. Unless the stand is very dense, however, bur-clover plants lie close to the ground, and mowing is very difficult. If bur-clover is to be grown for hay, it is preferably sown in mixture with oats or wheat, as with these grain crops the bur-clover plants tend to grow erect. Ordinarily about 5

bushels of bur-clover seed in the bur should be sown to the acre, together with 2 bushels of winter oats or $1\frac{1}{2}$ bushels of wheat. For growing in this manner, however, hairy vetch is preferable to bur-clover, and even crimson clover will ordinarily give larger yields under such conditions than bur-clover. Bur-clover hay is not regarded very highly and is seldom used.

GROWING AND HARVESTING SEED

CALIFORNIA BUR-CLOVER

Most of the commercial seed of California bur-clover comes from California. Much of the seed is harvested as an impurity with wheat and other grain crops, from which it is separated at the mills and warehouses handling grain. Occasionally some seed is harvested from pasture lands where burs in pure stands are often produced in abundance. The simplest method of harvesting is sweeping by hand with large stiff brooms. Ordinary mowers, self-rake reapers, combined harvesters, and specially devised suction machines have also been used. When the mower, reaper, or harvester is used, the crop must be cut before all the seeds are ripe, because the burs ripen unevenly and drop readily when ripe. As a consequence, a good deal of green material is harvested with the burs, which necessitates careful drying to prevent damage by heating and sweating. Furthermore, because of the half-prostrate habit of the plants, a large part of the crop is left on the ground.

The power suction machine saves all the seed, but the cost of operation is high. When this machine is used the burs are allowed to become perfectly dry, so that they are easily lifted from the ground by air suction.

When only a small quantity of seed is to be saved, the best method is to sweep by hand. When this method is used the seed is allowed to ripen thoroughly, and the vines are cut with an ordinary mowing machine and raked into windrows. The burs are swept together with large barn brooms and hauled from the field. The burs gathered in this manner are mixed with more or less gravel and other foreign substances, which must be removed before the seed can be satisfactorily hulled or used in the bur. This separation is accomplished by the use of handbarrow screens and an ordinary fanning mill regulated to blow the burs over; or, if running water is handy, a quicker and more satisfactory method is to throw the burs into the water. All heavy substances sink, and the burs and lighter substances are dipped from the stream. To facilitate separation, the channel of the stream should be narrowed in the shape of an open V, which aids in collecting the clean burs. To dip the burs from the water, a large handbarrow with a bottom made of wire netting has been found satisfactory. The burs are spread on canvas to dry, after which they may be successfully hulled with an ordinary clover huller.

A second source of the seed of California bur-clover, often mixed with spotted bur-clover, has been from the burs removed from wool. The quantity of these burs contained in wool is so large that it has been found profitable to save the seed in European wool-cleaning mills. Bur-clover of one or both species is abundant in Argentina and also in Australia, as well as in the Mediterranean countries.

SPOTTED BUR-CLOVER

Practically all the commercial seed of spotted bur-clover is grown in the cotton States. Thus far the seed has been marketed only in the bur, but hulled seed could easily be produced in commercial quantities should a demand for it develop.

On small farms, raking or sweeping the ripened pods from the ground is the common method used in harvesting spotted bur-clover seed. It is best to allow the burs to become perfectly mature or dry before harvesting. At this time the vines can be raked with a horse-rake without previous cutting, leaving the shattered burs on the ground. A subsequent raking with a handrake usually will be necessary in order to remove trash that slips between the teeth of the horse-rake. When the pods are not perfectly dry, care must be exercised in curing, as otherwise the piles will heat, with consequent injury to the seeds. It is probably because of such heating that the commercial seed so often has a low percentage of germination.

Every southern farmer can easily grow his own supply of bur-clover seed at small expense.

On large farms, specially constructed suction machines are used for gathering or harvesting the dry burs from the ground, and this is the source of most of the spotted bur-clover seed on the market.

YIELD AND WEIGHT OF SEED

Bur-clover seed closely resembles that of alfalfa. Formerly much of it was used to adulterate alfalfa seed, but this practice is now rare, because of the enforcement of pure-seed laws. The two kinds of bur-clover may be distinguished by their seeds (figs. 6 and 7) as well as by their burs.



FIGURE 6.—Seeds of spotted bur-clover.

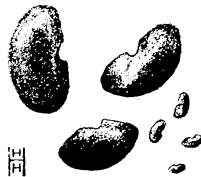


FIGURE 7.—Seeds of California bur-clover.

CALIFORNIA BUR-CLOVER

The average yield of hulled seeds in California is from 300 to 500 pounds per acre. The seeds weigh about 60 pounds to the bushel. One bushel of clean, dry burs weighs 6 to 12 pounds and contains 2 to 4 pounds of seed.

SPOTTED BUR-CLOVER

From a good stand the average yield of burs per acre in the South is about 500 pounds, but yields of 1,200 or even 1,500 pounds per acre are recorded. One bushel of spotted bur-clover seed in the bur weighs from 6 to 14 pounds. One hundred pounds of the clean burs contain 30 pounds of seed. The yield of clean seed per acre is therefore 150 to 360 pounds, or about half the yield of California bur-clover seed secured in California.

INSECT ENEMIES

The only insect that does any serious damage to bur-clover is the clover-seed chalcis fly, which also attacks red clover and alfalfa. This small, wasplike insect lays its eggs through the green pods into the soft seeds, where they hatch and develop, becoming mature insects and emerging by the time the seeds are ripe, or later. The quantity of seed thus destroyed is considerable. In California probably 10 percent of the early maturing seed is destroyed, and as much as 75 percent of the late seed. In the South the loss is probably not so great. No practical way of controlling this insect in bur-clover is known. It does no harm to the herbage.

OBJECTIONS TO BUR-CLOVER

Three objections have been advanced against the use of bur-clover as a forage crop:

(1) The relative unpalatability of the plant. This is most marked in the case of horses and mules, but other animals do not take to it readily at first. However, all farm animals kept on pastures soon acquire a taste for bur-clover and then eat it freely.

(2) The small amount of growth. This objection applies mainly to poor soils and to the northern portions of the Cotton Belt. Even where the growth is very small it is practically always sufficient to prevent the washing of the soil, and this, together with the very insignificant cost of securing a stand each year and the marked ability of the plant to grow in cool weather, makes it valuable, even though the growth is not large.

(3) The burs become entangled in the wool of sheep and thus reduce the value of the wool. This objection applies particularly to California and other regions where bur-clover is abundantly established on range lands. However, the value of the forage far outweighs the small damage done by the burs. On cultivated land the objection scarcely applies, as the difficulty is so easily avoided by removing the sheep from the pasture after the burs are ripe, or else pasturing the bur-clover so heavily that but few burs are formed. It is mainly on account of this objection that a spineless variety of bur-clover is considered desirable on cultivated land.